National Institute of Environmental Health Sciences

Temperature-derived potential for the establishment of phlebotomine sandflies and visceral leishmaniasis in Germany

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Abstract:

Climate change is expected to manifest in the shift of organisms to regions where they were not present in the past, potentially entailing previously unseen biological risks. However, studies evaluating these future trends are scarce. Here, an important group of vectors (sandflies) and the pathogen transmitted (Leishmania infantum complex) causing the infectious disease visceral leishmaniasis is investigated, focussing on potential establishment in Germany during the 21(st) century. As the most important habitat factor, temperature requirements of pathogen and vector were derived from the literature and compared with recent climate records - provided by worldclim - and climate change scenarios. Climate data from the Regional Climate Model REMO were obtained and averaged over the time periods 20112040, 2041-2070 and 2071-2100. Projected temperature changes (based on the A1B and A2 scenarios) were correlated with the constraints of vector and pathogen. Simulated potentially suitable habitat areas for vector and pathogen were merged to generate a temperature-derived risk map of visceral leishmaniasis. Temperature conditions seem to become suitable for the vector across large swaths of Germany. Nevertheless, temperature constraints for the pathogen may defer the establishment of the parasitic disease, particularly during the first half of the 21st century. Long-lasting epidemics of visceral leishmaniasis are therefore not expected in Germany during the next few decades, although during extremely warm years an increase in autochthonous cases of leishmaniasis may occur. The southwest (Upper Rhine Valley) and west (Cologne Bight) of Germany are identified as risk areas. The time of potential establishment and corresponding rise in biological risk varies between scenarios, due to differences in the predicted rate of temperature increase.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1, SRES A2

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

Temperature: Fluctuations

Geographic Feature: ☒

resource focuses on specific type of geography

General Geographical Feature

Geographic Location: ☒

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Germany

Health Impact: ☒

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Fly-borne Disease

Fly-borne Disease: Leishmaniasis

Model/Methodology: ☒

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type: ☒

format or standard characteristic of resource

Research Article

Timescale: ☒

time period studied

Long-Term (>50 years)